Neutron Cross Sections Evaluation with Taking Unrecognized Experimental Uncertainties into Account

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Unrecognized experimental uncertainties are a main source of the underestimation of evaluated cross-section uncertainties [1]. A method for taking unrecognized experimental uncertainties into account in statistical analysis of neutron cross-section measurements is proposed. The method is based on the construction of probability distributions for observable deviations of the the measurements from the model function within energy intervals. A compromise is achieved between a width of the energy intervals and the number of data sets and measurements falling into the intervals. As input information only measured cross-section values (as the data with essentially higher confidence level than declared uncertainties) are used. Special procedure is applied for refining constructed covariance matrices from the unphysical ones. A search of the vector of estimated parameters is carried out in iterative procedure with minimization of statistical functional and re-calculation of the covariances for the observable deviations at each step. As an initial approximation for the model function any of existing evaluations properly parametrized can be used.

A calculational scheme is heavily based on identical transformation of the equations of generalized least squares method [2]. In particular, the transformation permits to decrease a size of matrices to be inverted from the total number of measurements to the number of experimental works.

The method was applied for the evaluation of the (n,t), (n,f) and (n,g) reaction cross-sections on fissile isotopes. It produces reasonable results in cases when generally accepted statistical methods fail. A comparison with the results of calculations carried out with the GMA code [3] for the same experimental data bases is presented.

References

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